November/December 2007 >> Vol.34

AECMAGAZINE

DESIGN, MANAGEMENT & COLLABORATION IN THE BUILT ENVIRONMENT



BIM at HOK

The role of Revit in HOK's Docklands project

DWG name to be patented?

The ramifications of Autodesk protecting its IP

AUGI – Autodesk User Group International opens doors to UK users

AEC MAGAZINE
DESIGN, MANAGEMENT & COLLABORATION IN THE BUILT ENVIRONMENT

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TDOC updates document management tool



Version 5 of TDOC, the Construction Engineering Management Document Control (CEMDC) software for the civil engineering and construction sectors has been released by developers TDOC Projects Limited. The latest version features a new data browser which is claimed to make navigation easier, and FTP facilities for uploading documents. In addition, every document, drawing and email on the system can be indexed using an enhanced keyword facility. ***www.TECDSL.com***

3Dconnexion offers AEC sector precise 3D control



3Dconnexion's entire family of 3D mice - the SpaceNavigator, SpaceTraveler, SpacePilot, and SpaceExplorer - are all supported by the recently launched Graphisoft ArchiCAD 11. Continuing its push into the AEC market, the company also provides support for Nemetschek Allplan 2008 through its SpaceNavigator 3D mouse. 3Dconnexion's 3D mice provide architects and designers with enhanced control in 3D work environments. By simply moving the controller cap, a 3D CAD professional can simultaneously pan, zoom and rotate without stopping to select commands. An increase in pressure accelerates motion while a decrease in pressure slows motion for precise micro-adjustments. ***www.3dconnexion.com***

TurboCAD Mac v3 offers enhanced DWG support



Adept Scientific has announced the release of IMSI/Design's TurboCAD Mac v3 which supports Apple's Leopard OS. TurboCAD Mac v3 offers over 275 2D design tools, plus 7,000+ symbols, and additional 3D model and 2D floor plan template content. The system also includes updated DXF/DWG support with the ability to read/write AutoCAD files through to 2008 plus support for model and paper space. ***www.adeptscience.com***

Engineering consultancy to sell Deltek Vision

Cheshire-based engineering consultancy, Wilde FEA, has become a reseller partner for Deltek's Vision enterprise software. The move follows the Wilde Group's own successful implementation of the software last year. Using web-based technology and a single, centralised database, Deltek Vision integrates critical business functions such as resource and project management, accounting, sales and marketing, time and expense capture and billing. ***www.deltek.com***

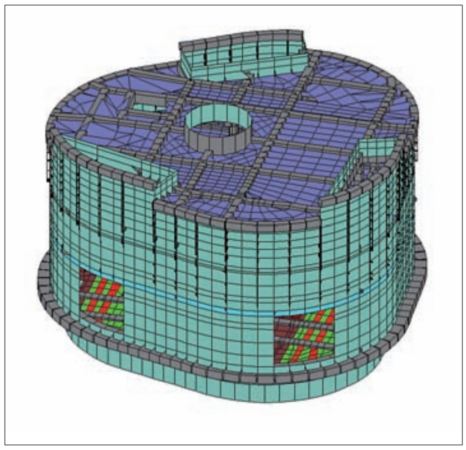
Bentley releases Staad.Pro 2007

Bentley Research Engineers Solutions Centre has released Staad.Pro 2007, Bentley's general purpose structural analysis program for static, dynamic, or pushover analysis of bridges, containment structures, embedded structures (tunnels and culverts), pipe racks, steel, concrete, aluminium or timber buildings, transmission towers, stadiums, and other structures.

The Staad.Pro 2007 supports more than 70 international design codes and addresses recent changes in European, US, and Southeast Asian design codes.

Staad.Pro 2007 includes the integration of RAM Connection, enabling users to analyse, design, and produce 2D drawings of simple and complex connections within the Staad.Pro environment. Integration is a major theme with Pipe stress engineers now able to integrate their AutoPipe models with the structural model and vice versa, plus improved bi-directional integration with Bentley Structural.

Grids can now be imported from MicroStation or AutoCAD (with all of the layers and blocks intact) and used to trace the



structural framing, and the system also includes new analytical features such as buckling analysis. Finally, a new optional advanced analysis engine increases runtime speeds by more than 1,000 times, claims Bentley. ***www.Bentley.com/StaadPro***

HP delivers second generation Quad Core family



One year on from the launch of its first Quad Core Xeon workstation, HP hosted its second Quad Fest event, this year in San Francisco. The workstation giant, who, according to the latest IDC figures, experienced 40 percent growth in Q2 2007, invited customers from all walks of life to share their experiences of HP's Quad Core workstation with journalists and analysts.

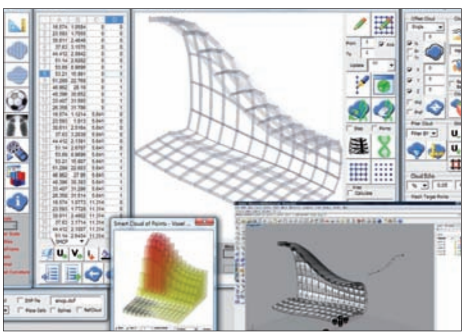
In terms of new technology, HP also unveiled two upcoming eight-core workstations – the HP xw6600 (pictured) and HP xw8600 – both powered by two next-gen Quad-Core and Dual-Core Intel Xeon processors.

The new machines will feature up to two next-generation Quad Core Xeon processor 5400 series or Dual Core Xeon processor 5200 series, based on Intel's new 45nm fabrication process, two full-performance PCI Express Gen2 x16 graphics slots, memory capacity of up to 128GB in the HP xw8600 and storage capacity of up to 5TB.

HP says its new workstations are also 90 percent recyclable by weight and now come standard with more than 80 percent efficient power supplies, saving businesses money by reducing power requirements.

"For an entire year, Quad Core Intel Xeon processors with leading energy-efficient performance have been enabling businesses around the world to work more productively," said Tom Kilroy, vice president and general manager, Digital Enterprise Group, Intel. "Before the end of 2007, we'll help enable even higher levels of productivity when the new 45nm Quad-Core Intel Xeon processor 5400 series and Intel 5400 chipset-based platform deliver breakthrough performance to help improve the processing and visualising of large amounts of complex data." ***www.hp.com/go/workstations***

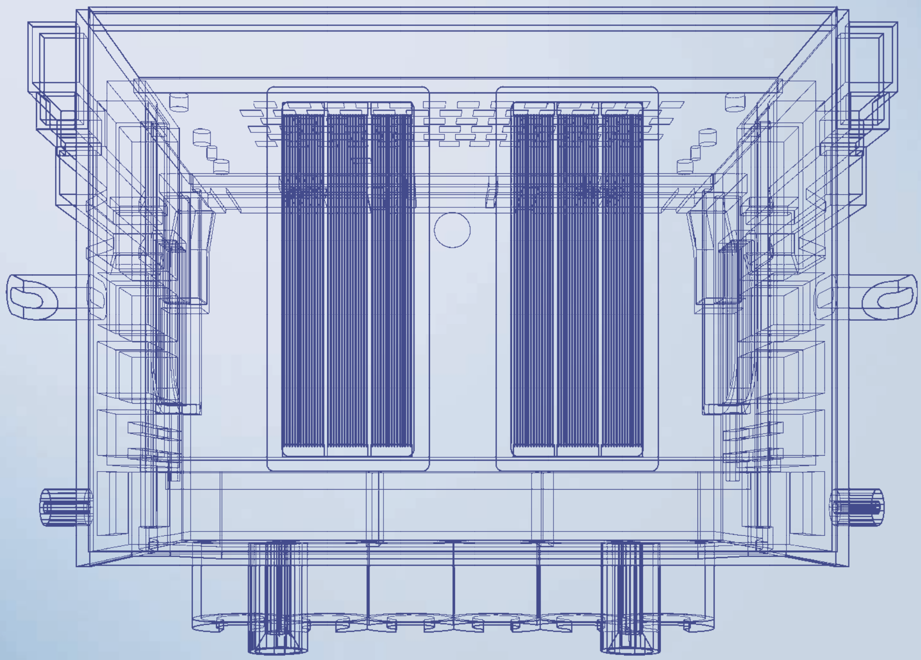
ParaCloud 1.0 to deliver generative design for Rhino



Paracloud has started the distribution of ParaCloud Modeler Release Candidate for Version 1.0 following beta workshops with high profile architectural practices and academic institutes. The low cost software is offered for purchase online, accompanied by the launch of a new support and training website at ***www.paraclouding.com***.

ParaCloud Modeler powers Rhino with parametric design tools through Microsoft Excel spreadsheets. It offers what is described as a unique "Scripting without Scripting" approach providing Rhino with generative design capabilities for fabrication, construction and performance studies. It offers tools for behaviour modelling, surfaces and ribs unfolding, parametric components population and performance driven design.

The new user community website offers video tutorials, case studies and documentation and the release of Version 1.0 is expected early 2008, offering a free upgrade to all beta users. ***www.paracloud.com***

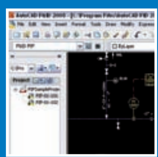


Dell claims 'first' with next generation workstations



Dell has introduced two new models of its Dell Precision workstations, the Dell Precision T5400 and the Dell Precision T7400. According to Dell it will be the first tier-one vendor to ship workstations with the latest Quad-Core and Dual-Core Intel Xeon processors 5400 and 5200 series, using Intel's latest 45nm manufacturing process. The Precision T5400 and Dell Precision T7400 start at £989 and £1,109. ***www.dell.com/uk***

CADline appointed reseller for Autodesk P&ID



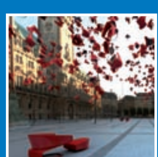
CADline, the Autodesk design software specialist, has become a reseller for Autodesk's new piping, instrumentation design and drafting solution AutoCAD P&ID 2008. Claire Bass of CADline predicts that P&ID will generate strong interest as it is based on the popular AutoCAD package, "With an estimated 50% of current designers scheduled to retire within the next ten years, AutoCAD P&ID has been launched at just the right time as it will help our clients avoid the skills shortage expected in the plant sector." ***www.cadline.co.uk***

New Scan2CAD Pro adds scan-to-PDF support



Softcover has released Scan2CAD v7.6, a new version of its professional raster to vector conversion software which adds improved automatic colour reduction and reads, writes and converts PDF (raster image only) files. A fully working seven day trial is available from the Softcover Website. ***www.softcover.com***

Architectural studio takes realism to next level



64-bit RenderServer technology from ARTVPS is enabling award winning architecture studio Moxon, to deliver even more complex 3D visualisations. Moxon typically uses large architectural models that include displacement mapping as well as specialist lens and volume shaders. These high demands meant that their previous rendering solution often failed even for test renders. Ben Addy, Director, Moxon, said, "One project for Italian furniture maker Tacchini required a number of chairs to be shown 'raining' on a piazza. The chairs are a particle system that is animated with full motion blur enabled therefore the required large amounts of data to be rendered." ***www.artvps.com***

Bentley gears up for GC launch



Dostyk Business Centre, Almaty, Kazakhstan.

Bentley Systems has started its trial program for generative design in architecture and engineering. The program includes a no-charge 90-day subscription to GenerativeComponents – Bentley's generative design software – and a Web 2.0 community "space" for users to accelerate their learning and to share ideas about this new approach to design.

In generative design, architects and engineers describe design components and relationships using powerful algorithms. As the design progresses, a change to one component in the system automatically drives changes to other related components – updating the design. Using this approach on even the most complex designs, Bentley says users can quickly explore a broad range of alternatives, speed their design iterations, and generate designs that are freer in form, more efficient, and more fit for purpose.

"In generative design, architects and engineers are achieving results and designs that were virtually unthinkable before," said Buddy Cleveland, senior vice president, Bentley Applied Research. "They've upgraded from using computers to simply speed the drawing process to employing immense computational power to discover their ideal design."

GenerativeComponents preserves and exploits the critical relationships between design intent and geometry. Users can, for instance, dynamically model and manipulate geometry, apply rules and capture relationships among geometric features, and define complex forms through concisely expressed algorithms.

"Emerging from work with the forward-thinking SmartGeometry Group, Bentley's generative design software was inspired by creative designers who were not content with the constraints imposed by the traditional CAD interface," said Makai Smith, GenerativeComponents product manager. "GenerativeComponents applied to their real-world projects was so compelling that we have decided to open this trial program to accelerate the learning curve for those architects and engineers so eager to raise the level of innovation in their work."

The generative design virtual community site will be located at ***www.be.org/gd***. It will deliver a set of GenerativeComponents-related resources from Bentley – including the software for download and on-demand learning – as well as an emerging community of blogs, wikis, forums, and a media centre for sharing generative design project work. Practitioners will be able to meet peers, share how-to tips and best practices, and learn about upcoming events such as SmartGeometry 2008." ***www.be.org/gd***

Civil 3D showcased at Construction Industry Awards

On the 20th October seven hundred or so of the great and good of the British construction industry gathered all in one place for the British Construction Industry Awards 2007. The focus was on the technicalities of the projects: challenges met, obstacle s overcome, sustainability goals achieved, and innovative designs realised on time and under budget. There was much less detail on the equally important measure of financial performance including cost justification, budgetary control, projected and actual return-on-investment.

Autodesk took the event as an opportunity to update the industry press on the progress of AutoCAD Civil 3D, now at version 2008 version, with a user on hand to talk about the product actually in use. Autodesk has broken with what it sees a common practice in the civils software business by writing Civil 3D from scratch, rather than just linking together products that the company has acquired over the years. Civil 3D 2008 embodies a number of improvements over previous versions, including enhancements to its visualisation capabilities and the ability to import and export Google Earth Surface and Photography.

Thomas Duffy from Duffy Chartered Engineers (DCE) shared his experiences with the product, "Autodesk Civil 3D is one of the tools we needed to make the transition from designing for private sector developers to handling larger scale public sector roads projects," he said. "When we discovered that there was three-dimensional road alignment design functionality in the product, we had demonstrations and concluded that the software would fulfil our requirements. Those requirements included increased productivity and particularly the ability to execute changes to the design with minimum effort. Our previous experience of using AutoCAD meant that our engineers achieved proficiency using Autodesk Civil 3D more quickly than they might with some other specialist design software."

"We've achieved a dramatic increase in design productivity, saving time and money by using Civil 3D. We've reduced turnaround times through the rapid incorporation of changes and we provide more accurate information to our clients, too," added Gary Barron, Civil and Traffic Engineer at DCE.

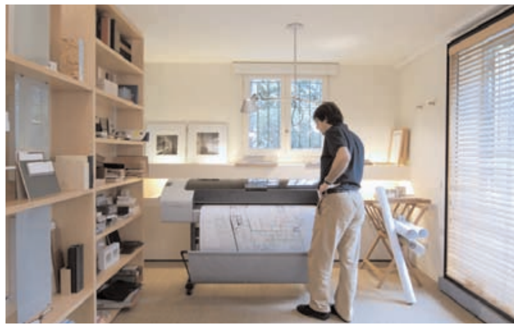
Thomas G. Duffy formed Duffy Chartered Engineers in 1992 and has managed a process of continuous development and growth since then. Based in Dundalk, Ireland, DCE currently have a staff of 24, including Engineers chartered in the fields of Civil, Structural and Traffic Engineering.

Duffy concludes, "We have recently been appointed as design consultants for two sections of major urban distributor road, approximately 2.5 km each. We are putting Autodesk Civil 3D to good use on these projects and are in the process of realising our expectations for it, providing a better design service to our existing private sector developer client base and to the architects who are working for them." *John Marchant*

www.bciawards.org.uk / www.autodesk.co.uk/civil3d

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Who owns DWG?

With rumours that Autodesk has been making plans to patent the use of the term DWG, **Martyn Day** looks at the reasons behind this move and the potential impact on the CAD industry.

There are some interesting rumblings coming over from vendors in the United States saying that Autodesk is attempting, and in some way succeeding, in getting DWG trademarked. In these litigious times, it may be a surprise that the term DWG, the native file format for Autodesk's flagship product, AutoCAD, wasn't originally trademarked by the company. It seems that most file format extensions since have been, but not DWG.

While this may have been an oversight on Autodesk's part, DWG has, with the popularity of AutoCAD, become synonymous with CAD data and nearly every major CAD system has some sort of DWG Import or Export. It's almost the basic currency of design; it's a ubiquitous de facto standard. It seems that over the past four or five years Autodesk has been making moves to get the patent on the use of DWG, the term. According to company CEO, Carl Bass, he feels that some firms were misappropriating it, so the company has taken steps to protect what it deems its format and usage of the term.

You don't have to look very far to see what's narking Autodesk. In the mid-range MCAD (Mechanical CAD) market, Autodesk is in a gunfight with SolidWorks over the cross-grade/upgrade of all those millions of AutoCAD users. SolidWorks has put considerable effort into producing DWG-based products to alleviate legacy issues for AutoCAD customers that move to SolidWorks, as well as providing translation tools between the various versions of DWG which, at the time, Autodesk was not providing. By lobbing these spanners in the works, SolidWorks was getting under the skin of Autodesk's management team. The long term play for Autodesk was to get DWG trademarked and remove the right for other vendors to create products with DWG in the title, or even use DWG in their manuals as a term.

"Autodesk feels that it is protecting its IP and from a certain perspective that's understandable. The question is why does Autodesk need to do this now when its business is romping away in all of its verticals?"

Open Design Alliance

The Open Design Alliance (ODA) is a not-for-profit company which was set up by Autodesk competitors to pool their funding and to reverse engineer the DWG format. In return members of the project get to use the DWG libraries that the company produces. You will find ODA libraries in SolidWorks, Bentley MicroStation, TurboCAD, SpaceClaim – nearly everyone that Autodesk competes with.

The proliferation of non-AutoCAD generated DWGs is another cause for Autodesk's concern. With products like Bentley MicroStation happy to work in its native DGN format or DWG, Autodesk has claimed that the ODA has caused many tech support calls which were cause by bad DWGs. To put a spanner in the ODA's works, Autodesk implemented a multi-prong approach to tackling them. Autodesk produced its own DWG libraries, 'RealDWG' which it licenses to friendly companies or swaps for mutual access, as it has done with PTC (which also dropped out of the ODA). Autodesk also altered the DWG format so that it included an encrypted portion which contained a simple sentence comprising trade mark terms like Autodesk. RealDWG files would have this and AutoCAD would detect DWGs that did not and warn the user they were about to open a non-Autodesk DWG file. The system worked like a watermark. The ODA decided to include the watermark and Autodesk sued them, with the ODA reversing that decision.

Now we have Autodesk trademarking DWG, the 'word'. Lawyers acting for the other CAD companies have been fighting this in the USA but it seems ultimately that Autodesk is winning and is already telling vendors to stop using the term DWG. We understand that the battle is now moving to European courts where Autodesk is seeking the same trade mark and the competitive developers are trying to put up the same defence. They argue that DWG is a standard abbreviation now and that it can't be trademarked. It will be interesting to follow this as it progresses.

Autodesk sees the ODA as a company that arms its competitors. Bentley has used the ODA to license DGN libraries but as Autodesk isn't a member it can't use them, which causes issues every time Autodesk buys a company which is an ODA member or user. As a result Autodesk has had to reverse engineer its own DGN libraries.

Conclusion

While this may look like a big bun fight, there could be implications for users and vendors that use DWG or DWG-compatible products. It will affect what other vendors can say about their products and could impact the usage of DWG on the web, media and technical documentation. Autodesk feels that it is protecting its IP and from a certain perspective that's understandable. The question is why does Autodesk need to do this now when its business is romping away in all of its verticals? I think it boils down to Autodesk getting fed up by being 'picked on' by SolidWorks and the ODA. Carl Bass has made claims that if the ODA was a level playing field and all members swapped their file format toolkits freely, it would be an interesting option for them. However, the board members joined the ODA to get DWG libraries not to trade toolkits.

Watch this space.

www.autodesk.com/realdwg
www.opendesign.com

"Carl Bass (Autodesk CEO) has made claims that if the ODA was a level playing field and all members swapped their file format toolkits freely, it would be an interesting option for them."

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Learn how NCPE got a fast return on its ProjectWise Investment: www.bentley.com/ProjectWiseSuccess.

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The user group returns

John Marchant attended the inaugural UK AUGI (Autodesk User Group International) Design Academy, but despite innovative workshops spread over two days, attendance figures fell short of expectations.

Over the years, there have been a number of groups in the UK catering for the interests of users of Autodesk products, though in recent years, they seem to have faded away. However, the user group is back, big time, under the umbrella of AUGI, the Autodesk User Group International. The UK chapter (chapter: US; an organisational division of a society or fraternity) of AUGI UK was established in June 2007 and is billed as 'an independent forum for users of Autodesk products to network, learn and share to become better and more productive users'.

Sense of belonging

Philip Madeley is AUGI UK Chairman of the Board of Directors. He says, "We'd found that users felt no sense of belonging. In large companies, the product may well be bought by the IT people and the actual users may not therefore be known. The users, though, want to learn and get better at using the products. To this end, we set up AUGI UK to bring together the disparate UK user groups and to get the benefit of being part of a worldwide community of users."

Free membership

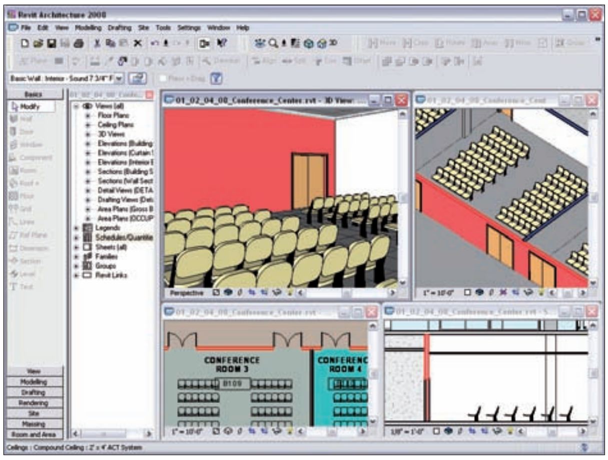
With over 100,000 worldwide members, AUGI is officially recognized by Autodesk as representing the Autodesk user community, membership is free, you don't have to have an Autodesk product and you don't need any serial numbers. You just visit the AUGI website and provide some simple data like your locality, and that is it. Somewhat more inclusive than some other vendors user groups!

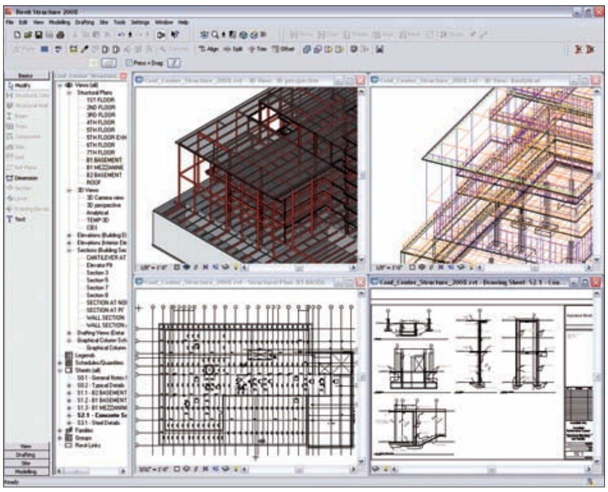
Autodesk sponsorship

Autodesk is clearly happy to see AUGI operating in the UK at last. Autodesk sponsors the organisation and events, supplying financial and logistical support and keynote speakers, flying them in from the US if necessary. AUGI assure members that their details are held in accordance with data protection legislation and are not passed on to any third party, especially not Autodesk.

AUGI Design Academy

AUGI UK's inaugural event was the Design Academy held on the 13th & 14th November at the Hilton Birmingham Metropole Hotel. Modelled on the Autodesk University, the Design Academy offered users 60 workshops spread over two days. Content ranged from Tips and Tricks to Help You Get the Most from Autodesk Inventor, to Managing Ordnance Survey MasterMap Data, so it wasn't just about AutoCAD, something that AUGI is keen to emphasise. Keynote speakers included Autodesk's Worldwide Technical Evangelist, Lynne Allen who succeeded in motivating the usual cool and restrained UK audience. The event was supported by a small exhibition populated by various Autodesk partners, resellers and developers, though from what I saw, they had a quiet time and the organisers may wish to consider how to attract more attendees to the stands or they may lose some exhibitors (and revenue) next time.





There's a lot more to the AUGI than just AutoCAD.

"We'd found that users felt no sense of belonging. In large companies, the product may well be bought by the IT people and the actual users may not therefore be known. The users, though, want to learn and get better at using the products. To this end, we set up AUGI UK."

Philip Madeley, AUGI UK Chairman of the Board of Directors.

Immediate productivity gains

Asked how learning at events like this is different to the training provided by Autodesk ATCs and resellers, Rich Uphus, Global Executive Director AUGI, replied, "Instructor-led training at a typical ATC is full day, deep learning, often aimed at new users. The type of workshops we offer at the AUGI Design Academy are for more advanced users and are focussed on being able to provide immediate productivity gains for experienced users. We want them to be able to walk away with something they can do the next day."

Wish-list

AUGI also maintains a product feature wish-list and the top 40 wishes go to Autodesk as candidates for inclusion in future products. Shaun Bryant is Coordinator for the UK Country Chapter. "The wish-list is of enormous value to Autodesk," says Bryant. "We've already had a meeting with Autodesk to update them. Its valuable too, that AUGI is independent of Autodesk so they get an independent user view." He adds, "Our aim is to grow the membership from its current level of 6,500 to 10,000 by this time next year. To do this, our challenge is to produce events that deliver real knowledge, access to networks and contact with like-minded users."

A promising start

According to AUGI, there were 250 users at the first day of this inaugural event, though they say they are targeting a larger audience. Given that it cost £375 for a two-day entry and UK operations started only a few months ago, AUGI saw this as a promising start. Knowing how difficult it can be for users in the SMEs (with the emphasis on the S!) that are Autodesk's typical constituency to get time and budget to attend off-site training events, 250 isn't bad. It is though but a small proportion of the hundreds of thousands of Autodesk users in the UK and in my view, AUGI will have their work cut out to reach anything like a reasonable number of these. I'm sure they'll try. ***www.augi.co.uk***

John Marchant is Consulting Editor of AEC Magazine. He also writes case studes for the skilstream partnership, where he is a senior partner.
john.marchant@skilstream.com

Scan to PDF

PDF is ubiquitous, and is becoming an increasingly popular format for storing scanned drawings. However, there's much more to Adobe's Portable Document Format than meets the eye. **Steve Hannath** of Softcover takes a closer look at some of the benefits and considerations.

Scan-to-PDF is something that a growing number of CAD users want to do with a wide format scanner. The popularity of PDF is slowly replacing traditional scanned image raster file formats like BMP, TIFF and JPEG for sharing drawings, archiving and other purposes.

All scanning software supplied with the major makes of large format scanners now save scans as PDF files. While this highlights the growing popularity of the PDF file format among CAD and scanner users, what exactly are the benefits of saving scans as PDF files and do these benefits extend to scanned technical drawings?

PDF - what and why?

Adobe Systems has been a historic innovator in the graphics software market. Portable Document Format (PDF) is a file format created in 1993 by Adobe for document exchange. PDF is an open standard and is now being prepared for submission as an ISO standard.

Adobe's PDF file format was originally intended for general purpose DTP graphics and office work, like saving artwork and marketing brochures as small files for email or web use, as well as converting general office documentation, like orders and invoices for storage. CAD functionality came late but its use in CAD is now widespread. Despite the best efforts of Autodesk to promote its DWF file format as a true CAD file viewing alternative to PDF, many AutoCAD users, perhaps the majority, have chosen to use Adobe's popular file format.

Why do CAD users want to save drawings as PDF files?

They do so for the following benefits, all of which are true.

- PDF is popular, ubiquitous and free to view.
- PDF files can be shared with customers and colleagues.
- PDF is supported by a plethora of inexpensive writers and readers.
- PDF files can be marked-up with comments without affecting the original data.
- PDF files enjoy flexible printing controls.

There are other perceived benefits that may or may not be true. These are:

- PDF files include intelligent CAD information.
- PDF files are secure.
- PDF files are small and are suitable for emailing and web usage.

Let's examine these perceived benefits from the standpoint of scan-to-PDF creation and raster to vector conversion.

PDF files include intelligent CAD information

There are essentially three types of PDF file that are used in CAD work: vector, raster and a mixture of both (hybrid).

Vector PDF files are created and saved from a CAD program using any one of a growing number of programs that save CAD drawings as PDF files.

The most obvious product to use to turn a CAD drawing into a vector PDF file is Adobe Acrobat but as this is generally regarded as an expensive option and the majority of CAD users use something more affordable, like AcroPlot Pro or Bluebeam PDF Revu, two professional alternatives. There are also many other solutions that are significantly cheaper or free.

To all intents and purposes vector PDF files look as crisp and sharp as any DWG, DXF or DGN vector file. Depending on the software used to create them, vector PDF files can contain intelligent CAD information, like selectable, viewable layers.

Raster PDF files are created when a technical drawing or document is scanned and saved to PDF using software like Colortrac's ScanWorks, Contex's WIDEimageNET or Graphtec's Scanning Arts.

While scan-to-PDF users gain some of the benefits of saving to PDF, such as ease of viewing and printing, for all practical purposes a scan-to-PDF file is just a raster file, like a TIFF or JPEG, enclosed in a PDF wrapper. It is a flat, unintelligent scanned image every bit as "dead" as a drawing on paper.

Scanning to PDF adds no extra intelligence, like layers. The image quality of a scan-to-PDF file is subject to the exactly same requirements that determine the quality in any other type of scanned image. Make a poor quality scan and you save a poor quality PDF file.

Many companies thought PDF secure and saved valuable proprietary CAD drawings as PDF files because they did not want their CAD drawings to be copied.

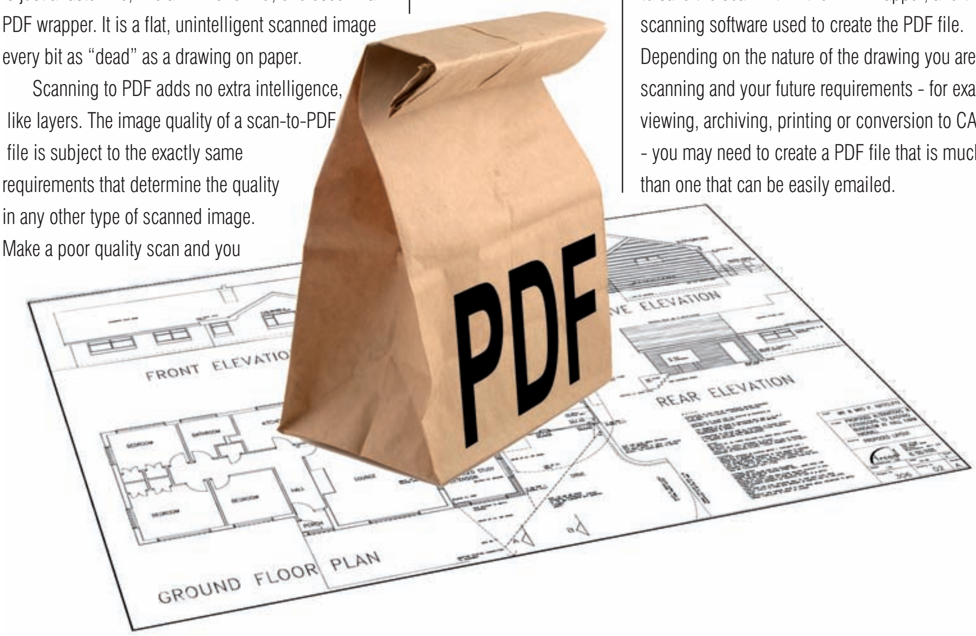
Today, there is a software industry dedicated to supplying programs such as PDF2CAD that convert vector PDF files back to DXF or DWG. Because vector PDF files contain vectors, i.e. real entities like lines, they are relatively easy to convert back to CAD.

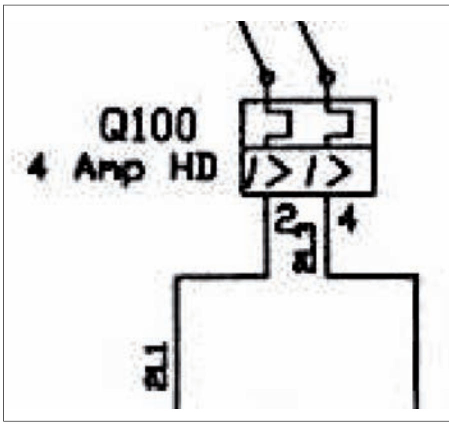
Raster PDF files are much more difficult to convert into accurate CAD drawings than vector PDF files. Raster PDF files are just scanned images made up of thousands of black and white or coloured squares (pixels). Raster PDF files either have to be redrawn by hand or interpreted back to lines, arcs, circles, etc. using a raster to vector conversion program like Scan2CAD Pro, which can read raster PDF files and convert them to DXF.

Because of the ease with which vector PDF is converted back to CAD and the difficulties of converting raster PDF files to CAD, some companies now supply scan-to-PDF files as a means of frustrating those who would copy them.

PDF files are small and are suitable for emailing and web usage

The size of a raster PDF file is determined by the size of the drawing; the amount of detail on it; its scan resolution; whether it is scanned in monochrome, greyscale or colour; the compression format used to save the scan within the PDF wrapper; and the scanning software used to create the PDF file. Depending on the nature of the drawing you are scanning and your future requirements - for example viewing, archiving, printing or conversion to CAD - you may need to create a PDF file that is much larger than one that can be easily emailed.





A black and white drawing scanned in colour at too low resolution, then saved PDF using JPEG compression with consequent blurring and speckle artefacts.

Size of the drawing: All other factors being equal, larger drawings will create larger PDF files.

Amount of detail on the drawing: The more detailed the drawing, the bigger the file. We recently scanned two different A1 monochrome architectural drawings on the same scanner at 300 dpi. One had more, the other less, detail.

- Drawing A (less detailed) - 134 kb PDF file
- Drawing B (more detailed) - 404 kb PDF file

Scan resolution: The lower the scan resolution, the smaller the PDF file will be. As an example, we scanned an A0 mechanical drawing in monochrome at different resolutions. This created PDF files of the following sizes:

- 200 dpi - 102 kb
- 400 dpi - 210 kb
- 600 dpi - 330 kb

If you are only going to be viewing or printing the file you can typically get away with a lower resolution, like 200 dpi, than if you are intending to convert the file to CAD. For raster to vector conversion to CAD you need to scan your drawing at a high enough resolution, anything from 200 - 600 dpi, so that parallel entities are separated by clean white space and small details are captured in sharp detail.

NOTE: If you are unsure about the future use of your file, remember that if you scan at too high a resolution you can always reduce the resolution later, but that if you scan at too low a resolution you can never add or recover the detail you have lost without scanning again. As many technical drawings are often destroyed after scanning in order to save drawing storage space the option to rescan the drawing later is not always available.

Monochrome, greyscale or colour: Monochrome scans are much smaller than colour scans. For example, we scanned the same A1 architectural drawing at 300 dpi in monochrome and colour:

- Monochrome - 134 kb PDF file
- Colour - 5 MB PDF file

We have seen colour PDF files of CAD drawings up to 60 Mb in size. By no stretch of the imagination is this a small, emailable PDF!

If you have a black and white technical drawing you should always scan it using your scanner's monochrome scan settings. It sounds obvious, but you'd be amazed at the number of CAD users who scan black and white drawings using their scanner's colour settings to produce a file many times larger than it needs to be and then reduce its quality by saving it using JPEG compression.

Compression methods used: When your scan is saved within the PDF wrapper it is compressed to make it smaller. Different compression methods make larger or smaller PDF files. Some scanning software allows you to select the PDF compression method, others do not.

Typically the scanning software supplied with a scanner saves monochrome scans using TIFF Group 4 compression and colour scans using JPEG compression. Both of these are effective compression schemes, but both have hidden issues that you need to be aware of.

Some software supplied with large format scanners, including Contex, Oce and Xerox, gives you the option to save monochrome scans as "stripped" TIFF Group 4 PDFs. The danger is that you may inadvertently select this option. Avoid it.

If you use the stripped option the scanned image in your PDF file will be split into a series of separate, horizontal strips. **See Figure 1.** This is a hangover from the early days when PC resources were smaller and images were loaded piece-by-piece. Although a stripped PDF image appears to be a single image when you load it into Adobe Reader 8, if you click on the image to select it only a narrow horizontal strip is highlighted.

Many programs that read PDF files will not read stripped images, or if they do read them, they will not display them as a single image. So, when scanning to PDF it is important to ensure you have selected the correct settings before saving the PDF file. Failure to do so may not be immediately obvious to you now but may result in unfortunate consequences later.

JPEG uses "lossy compression" where it loses or discards data that it thinks you can do without. This causes it to decrease the quality of scanned drawings by blurring the details and adding speckle artefacts.

This is probably not an issue if all you want to do is view or print your scanned PDF files. However, if you want to perform raster to vector conversion on them you should avoid JPEG compression if your scanning software gives you

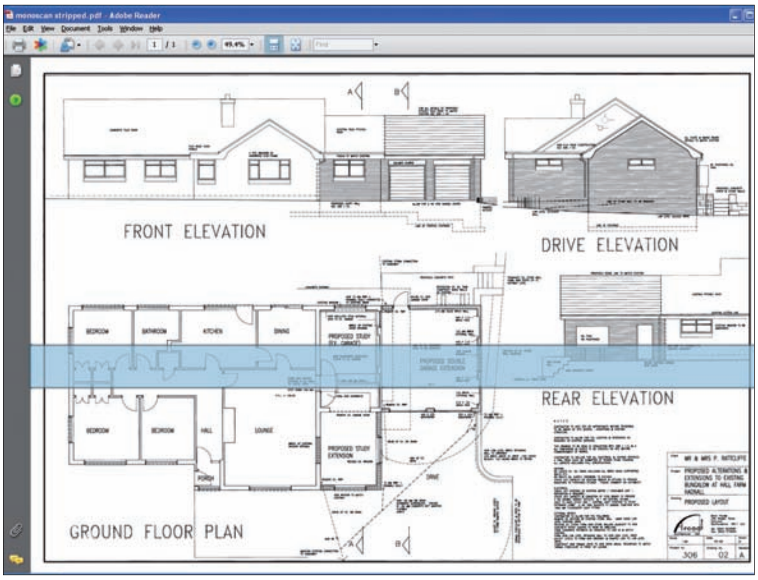


Figure 1: ***clicking on a stripped Scan-to-PDF file in Adobe Reader 8 selects a thin horizontal slice.***

the option to do so. This may mean that the PDF file you create is larger.

Scanning software used: Different scanning software can create different sized PDF files even when using the same compression method. We recently received a PDF file that was almost 12MB in size. The same PDF file saved using the same compression method in another program was just 400kb.

The reason for the difference in file size was that in addition to the scanned drawing, the 12MB file contained information such as how to display colours on different systems. While this might be relevant for graphics files where colour is important, it is irrelevant to technical drawings and just inflates the size of the PDF file.

If PDF file size is important to you, get a test drawing scanned on different scanners using different scan software and choose the solution that creates the smallest PDF files while retaining the quality you need for your intended end use.

Conclusion

Before CAD users scan-to-PDF they first need to have a firm idea of:

- What the scan's ultimate purpose will be.
- Which of the benefits of PDF they want to gain.

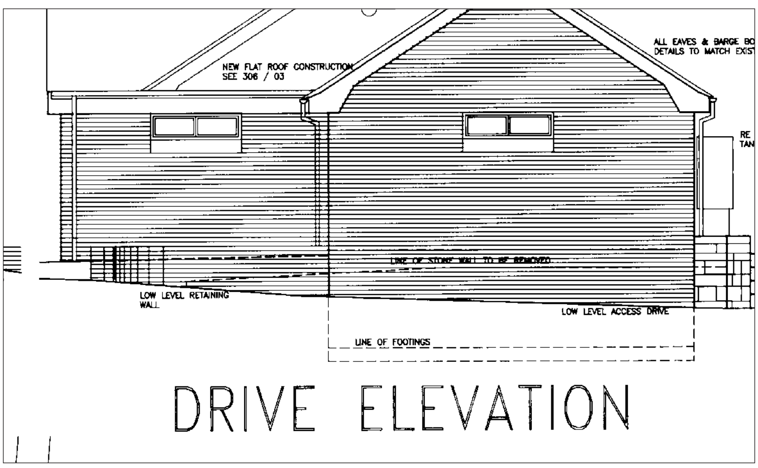
While scan-to-PDF users will gain some of the benefits of PDF such as ease of viewing and printing, for all practical purposes a PDF file created using scan-to-PDF is just a raster image - usually TIFF or JPEG - in a PDF wrapper.

As such, PDF files are subject to the same scanned image quality issues as any normal raster file and, like any normal raster file, they contain no intelligent information and can only be converted to CAD by redrawing or using a raster to vector conversion program such as Scan2CAD Pro.

Perhaps most dangerous misconception is that PDF files are small and emailable. In trying to make PDF files as small as possible, users may degrade the level of detail and quality and make them unsuitable for CAD use in the future.

If the ultimate use of the PDF file is quality dependent, such as archiving or raster to vector conversion, the ONLY consideration should be to create a PDF file with the best possible image quality. Only image quality can provide a scan-to-PDF user with useful long-term results.

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Data deja vu

Reusing the right drill-site design data has helped reduce oil field engineering costs by $2 million for ConocoPhillips Alaska Inc. (CPAI).

Located in the frozen tundra north of the Arctic Circle, Alaska's North Slope oil fields produce 16 percent of the U.S. domestic oil supply and 90 percent of the State's revenues. The No. 1 oil and gas producer in the State, ConocoPhillips Alaska Inc. (CPAI), invested about $1.6 billion in exploration, development, operations, and maintenance last year, including $750 million in capital projects.

To overcome the challenges of remote location, extreme climate, and complex regulatory environment on the North Slope, CPAI partners with specialist Alaskan oil-field service contractors such as VECO Alaska Inc. VECO became globally known in 1989 as prime contractor in the Exxon Valdez oil spill clean-up. Today, the contractor has more than 4,000 employees supporting the energy, resource, and process industries throughout the world, and generates annual revenues of $1 billion.

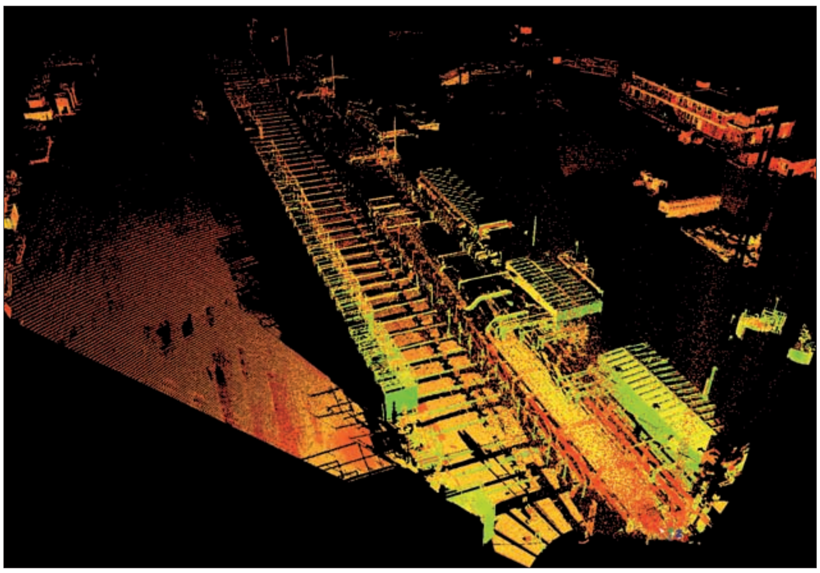
More than half of the VECO workforce is in Alaska, where engineers apply innovative technology to support CPAI's oil and gas production. From 2004 to 2005, VECO designed drilling sites for two new Alpine satellite oil fields - the Fiord oil field (CD3) to the north and the Nanuq oil field (CD4) to the south - which CPAI developed at a cost of more than $675 million. In 2005, CPAI challenged VECO to help reduce costs by reusing CD4 data for a new CD5 drill site at Alpine.

Reusing drill-site design and engineering data was conceptually possible, but it had not been done before within the CPAI managed environment. VECO's Design Technologies Group (DTG), lead by Mark Christenson, design techologies manager, worked out a process that not only saved time and money, but also preserved project knowledge about how to resolve drill-site design issues. In mid-2006, when CPAI discovered Qannik, a satellite development overlying the Alpine oil field, VECO again reused design data, making CD5 the design basis for Qannik.

Using a combination of AutoPlant and ProjectWise (in compliance with CPAI's managed environment), VECO manages and stores all 2D and 3D drawings, supporting designs, and project management documents in a central location with secure access. Document attributes entered via ProjectWise automatically propagate to the title blocks in AutoPlant documents, eliminating duplicate data entry and maintaining consistency between design and engineering. As documents progress through design, they are routed for review, attributes updated, and editing rights eventually restricted to select users. Individual components progress at their own pace, so projected completion dates are accurate and reliable.



VECO reused intelligent CD4 drill-site data to create the CD5 drill-site design within a managed environment.



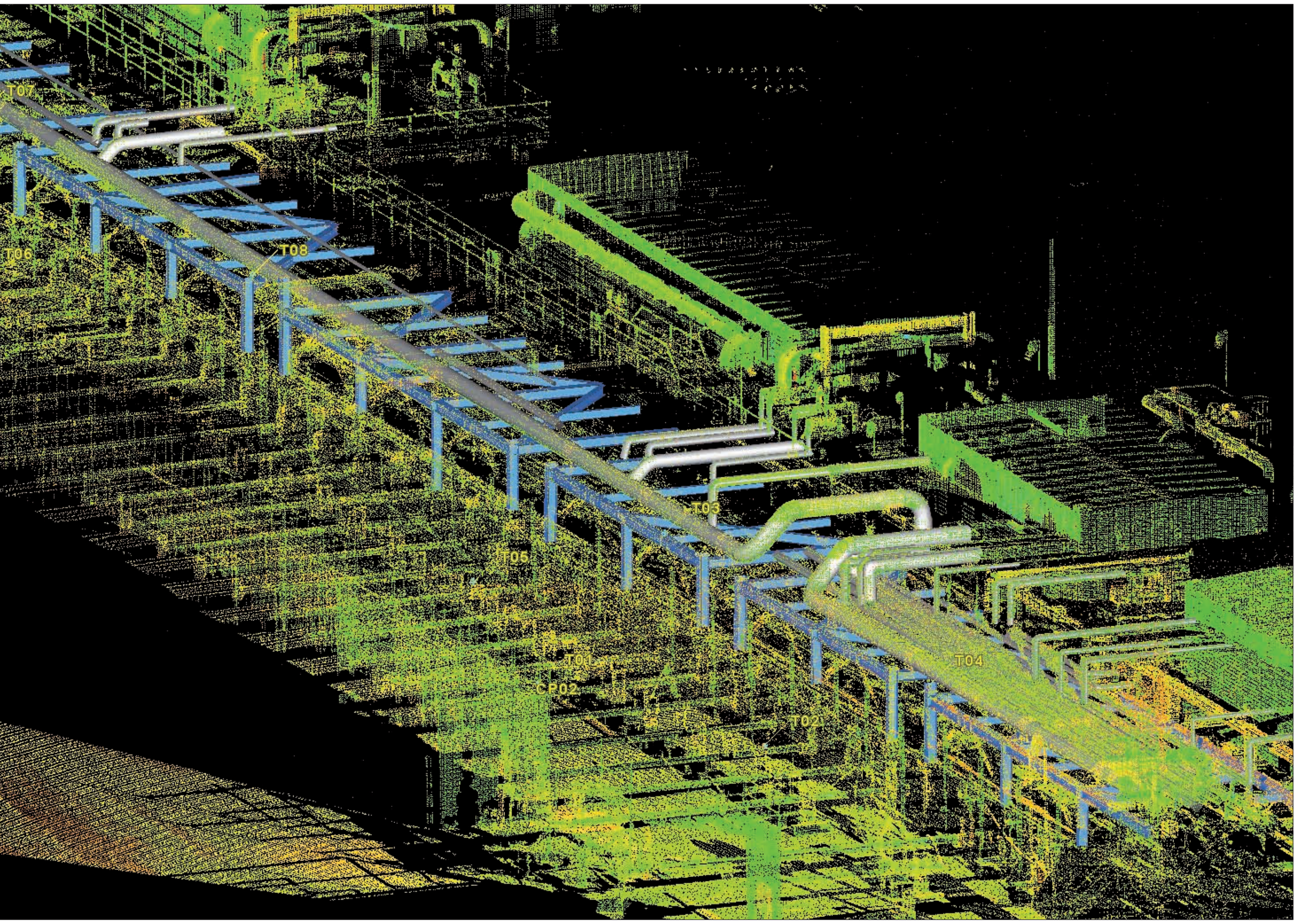
A virtual walk-through eliminated interferences between new and existing equipment.

"VECO uses ProjectWise and the entire AutoPlant suite to produce cutting-edge designs," said VECO project manager Steve Preston. "Repeating these designs and reusing the data produces an estimated 20 to 30 percent cost reduction compared to 'from-scratch' projects."

VECO's client, CPAI, monitors design progress by accessing project data through the ProjectWise Web portal. At specified milestones, VECO transmits deliverables to the client from the distribution server. "ProjectWise enables us to maintain positive control of documents without imposing undue restrictions on their accessibility," Preston added.

Replicating intelligent data

Reusing drill-site data, however, is not a simple process of copying documents to a new project directory. VECO combines several Bentley



technologies to produce "intelligent data" that can be reused without losing linked information. For example, reusing the data requires successful linking of component tags across the Bentley applications, as well as changing tag numbers to reflect a new project.

VECO's DTG supplements existing Bentley utilities with eight custom tools to streamline the process for copying project data. For each new project, these tools are used to rename batch files based on defined strings, update the internal drawing dictionary, update drawing reference paths, batch rename reference drawing file names, detach references that aren't required, batch update specification names for all model components, update model layer names based on new process lines, and clean up extraneous data.

Reporting capabilities are also customized. For example, to produce instrumentation and wiring schematics, diagrams, and termination drawings, VECO's DTG has developed customized queries that capture real data within the drawing deliverables. When the data is reused, this eliminates hours of work associated with document production. VECO's DTG also customized Bentley software to provide a way to generate a report on material requisitions and associated documents based on specific project attributes. The function spans multiple applications and enables users to export the report in nearly any format.

Over the 23-week project duration of the CD5 Project, VECO's DTG successfully copied and organized the drill-site designs using Bentley-supplied technology and adapted/developed supplemental tools as needed to complete the task. The result was a fully linked, ProjectWise-enabled AutoPLANT project delivered on time.

ProjectWise stored all 2D and 3D drawings, supporting designs, and project management documents in a central location.

During this same time period, VECO performed retrofit design work for the Alpine oil field's CD2 pad. VECO's Laser Scanning Team traveled to Prudhoe Bay in August 2006 to gather as-built information using a state-of-the-art laser scanner and Bentley CloudWorx. The team captured highly accurate data for 600 linear feet of pipe rack and piping, as well as tie-in areas for future retrofitting. Scanner data imported into AutoPLANT became the basis for a 3D model of the retrofit design. A virtual walk-through not only eliminated interferences between new and existing equipment, but also avoided late-stage design objections by operations personnel.

"Using Bentley software enabled the team to find problems before they became major, saving both time and money," Preston said. "The design team was able to realize improved quality of engineering information. Project productivity was also improved by the smarter use of shared information, shared documents, and reporting tools. Data integrity was improved by providing weekly reports."

"The design team was able to realize improved quality of engineering information. Project productivity was also improved by the smarter use of shared information, shared documents, and reporting tools. Data integrity was improved by providing weekly reports."

VECO project manager Steve Preston.

On projects totalling an estimated $250 million, VECO innovations have saved about $2 million and 23,000 man-hours. By successfully reusing existing drill-site designs for CD5 and Qannik, VECO reduced the forecast for peak staffing requirements at the execute phase to just 70 employees - about 35 fewer engineer team members than had been needed on the CD4 drill site.

"Many of the design issues have already been resolved by the team that generated the previous drill-site design," said project specialist Andy Toth. "I look forward to further reducing costs through more effective use of the Bentley tools during execution of the CD5 and Qannik drill-site projects."

Oil production at these drill sites is expected to begin by late 2008. By then, CPAI will have invested nearly $500 million to develop the satellite sites at Alpine and increase oil production to 135,000 barrels per day, generating more revenue for the state of Alaska and supplying more domestic oil to meet U.S. demand.

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Bridging the gap

Nonlinear FEA (Finite Element Analysis) is playing an increasingly important role in building better and more economical bridges for the future.

Historically, most large bridges are "overdesigned" with substantial margins of safety built in to compensate for unknown forces that could affect their integrity over time. For the reliability, maintenance and economic viability of the bridges of the future, better performance from the ground up is critical.

Penn State University Civil and Engineering Associate Professor Daniel Linzell and his research group employ advanced Finite Element Analysis (FEA) to create computer models for studying the structural behaviour of bridges. Using this technology, Linzell and his graduate students are able to focus in on potential trouble spots in individual bridges, helping civil engineers anticipate problems and make adjustments before construction begins. The simulation results can also be used to make decisions about maintenance requirements.

Modelling real-world stresses

"Civil engineering has until very recently relied on linearly elastic, small deflection FEA methods used in software tools as the backbone of bridge analysis. However this method is, in many instances, an approximation and doesn't capture the full range of real-world nonlinear responses in these increasingly larger and more complicated structures," says Linzell. "Higher-order methods found in advanced FEA software are becoming more commonplace in the industry because they provide the capability to incorporate nonlinearities to account for realistic stresses and deformations that will influence the performance and service life of a bridge."

Aspects that can be incorporated into an advanced FEA model in addition to material and geometric nonlinearities to assess the structural integrity of a bridge include the response of concrete or steel to the weight of the bridge itself as well as to traffic, wind, water, temperature fluctuation, corrosion, and even time (both concrete and steel "creep", resulting in long-term deformation).

Economic factors

Economics is another driving force behind the need for more sophisticated analysis tools, Linzell says. "Extreme over-designing has become too expensive.



New bridge under construction, with pre-stressed concrete beam being lowered into place by hydraulic crane. Dr. Linzell's group creates computer models, using Abaqus finite element analysis software, to study the structure and behaviour of the bridge as it is being built, helping civil engineers make design adjustments as work progresses.



View from beneath a new bridge under construction, showing pre-stressed concrete beams and deck at the abutments. The weight of the bridge itself, as well as traffic, wind, water, temperature, corrosion and time all contribute stresses and deformations that influence the performance and service life of the structure.

There's now a strong push to minimize material costs and simplify design to reduce labour."

Lighter, stronger materials are being developed: steel that is available now has yield stresses of 100ksi (100,000psi), almost three times what they were just 10-15 years ago. But while stronger steel allows builders to use smaller sections to support the same bridge loads, the new materials may also be more flexible. "You need higher-order tools to better predict such nonlinear geometric deformation," Linzell points out.

Improving communication

Linzell's group is concerned about a long tradition of separation between designers and constructors in the bridge industry. "Designers need to understand that a bridge doesn't arrive in one piece and get dropped into place; on site construction decisions can influence bridge life and functionality. You have to think about how it's going to be built because that in turn influences how it's going to perform in the end," he says.

"What we're trying to do is come up with guidelines or tools which will bring designers and constructors closer together. Those are the intentions with what we're doing with our FEA models."

How to build a virtual bridge

Linzell's group uses Abaqus/Standard software from Simulia, Dassault Systèmes' brand for realistic simulation, to create these virtual bridges. First they build a numerical model based on an existing design. (They can work with designs that are still on paper, or in CAD format, or use as-built measurements taken from a structure already under construction.)

They next select elements (these are the tiny geometric shapes, mathematically representing physical units that are linked by nodes to form a numerical model) and then material models. "You choose elements depending on available material (constitutive) models and geometry then select what's best for the materials being used, such as concrete or steel."

Next they set up the boundary conditions for the model. "We use Abaqus a lot in this stage," he says. "We select how the bridge is going to be restrained, whether we are going to utilise a contact condition or a discrete restraint, and how friction will be represented, for example."

Finally Linzell's group applies various loads to the parts of the bridge, such as onto the bridge deck to represent vehicle loads or onto the beam faces to represent wind loads. (Stresses can be determined either at nodes or in the elements themselves.) "This is a fairly prescribed process, but it depends on what you are looking at – such as traffic loads, or the weight of the structure itself," he says. The Abaqus creep module is used for time-dependent factors. "Creep is a big issue with concrete, and similar time-dependant effects influence steel behaviour as well. Thermal loads are important, too: We've taken data from bridges where there was a 50-60 degree temperature change during construction that certainly affected structure behaviour."

Depending on where loads prove to be excessive, the bridge model and, ultimately, the performance of the actual bridge, can be modified. The process can be repeated until the optimum configuration for the bridge is reached. "There's a lot that goes into modelling how a massive, highly-indeterminate structure like a bridge is going to respond," Linzell notes. "Abaqus helps us get our bridge models as accurate as possible."

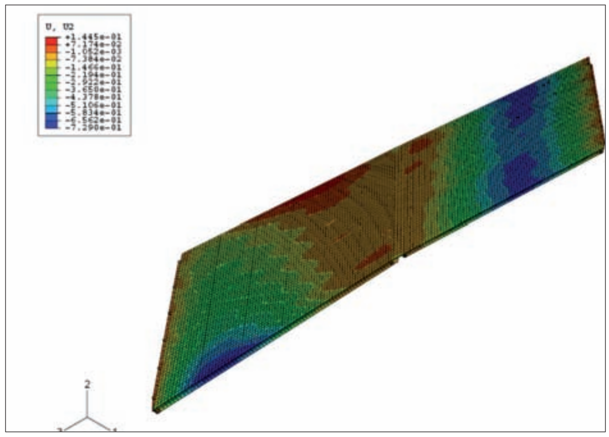
Real world applications

The software has other application potential in the field of bridge analysis besides designing and testing new structures, according to Simulia senior engineer Deepak Datye. "Abaqus can be used to evaluate the residual life of a damaged structure which is still standing, but may be cracked. And it can also be used for forensic purposes, to help pinpoint the reason for a collapse."

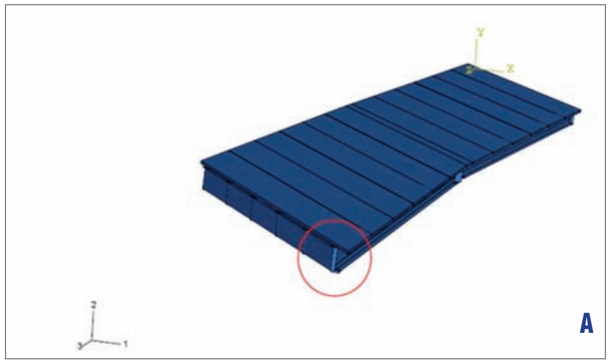
Linzell sees nonlinear FEA playing an increasingly important role in building better bridges for the future. He is part of a group of researchers, practitioners and Department of Transportation (DOT) engineers who are collecting questionnaires from fellow bridge-building professionals related to their current use of numerical tools.

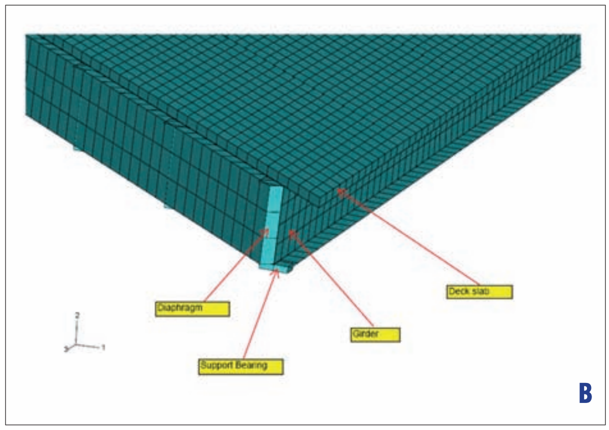
"We are hoping to come up with unified FEA guidelines for bridges because our industry really doesn't have a unified publication yet," he points out. "Other disciplines like aerospace engineering, and to some extent mechanical engineering, already do, so we're trying to initiate that process."

www.simulia.com



Abaqus 3D finite element analysis (FEA) model of vertical displacement contour of a bridge deck, representing how the entire bridge moves under its own weight.





A. ***Corner of bridge superstructure at abutment.***
B. ***Detail of bridge deck, diaphragm and beams at abutment showing Abaqus three-dimensional brick elements used to predict structural response. The elements mathematically represent structural components and are linked together by nodes to form the model.***

A question of integrity

How can structural engineers ensure Building Information Modelling (BIM) data remains reliable? **Simon Jones**, Autodesk Northern Europe, explains.

When the idea of building information modelling (BIM) was first introduced, it was met with a healthy scepticism. However, suddenly the coin has flipped. An increasing number of large firms have already adopted the method of working and now smaller practices and consultancies are following suit.

One of the reasons for this is the introduction of structural engineering BIM tools. A key benefit of BIM is the ability to share digital model data amongst the design team - and when structural engineers have the right tools to be able to add their data to the single model, the entire concept begins to make sense.

However, the more disciplines that access and use the building information model, the more opportunities there are for error and corruption. So, how can the integrity of the building information model be maintained during the structural engineering process?

BIM is a building design and documentation methodology characterised by the creation and use of co-ordinated, computable information about building project in design and construction.

The BIM model can contain data for all parts of the building including architectural, structural and building services information at any stage of the project; prior to construction, during construction and post-construction.

It's easy to see why BIM has been popular with building owners as it brings many benefits to a project as a whole. For example, the ability to track changes between individuals within a single office and even between disciplines.

An engineer receives the building information model from an architect and then changes the size of a certain structural feature to ensure its strength. When the model is sent back to the architect, the changes are automatically updated in the architect's building model.

It also helps productivity levels because of the need to develop only one model instead of several in each design discipline. However, what is becoming increasingly clear is that the method also brings significant rewards on a day-to-day basis, for the engineers within their own office.

Yet, architects and structural engineers need different things from the model. Traditionally, the structural engineer's work involves assumptions and educated guesses. In general, architectural drawings contain much information that is superfluous to the engineer.

The first stage of the engineering process is usually to rationalise this data to produce engineering data. Such data includes initial "guesstimates" of beams/columns and the position of beams, columns, floors and walls in 3D, plus any other features that affect the overall stiffness of the structure, such as openings in floors and walls.

A particular challenge in creating the structural model is that that the engineer is not really - at this initial analysis stage at least - interested in the exact shape of an element, but rather the need to represent its position in the 3D model. Its centre line (as represented by the architect) does not necessarily correspond to the desired position in the analysis model.

A similar problem occurs when considering walls and slabs of differing thickness. For example, a wall from the first to second floor is often thicker than the corresponding wall from the second to third. In an architectural model, this would be represented as "in reality".

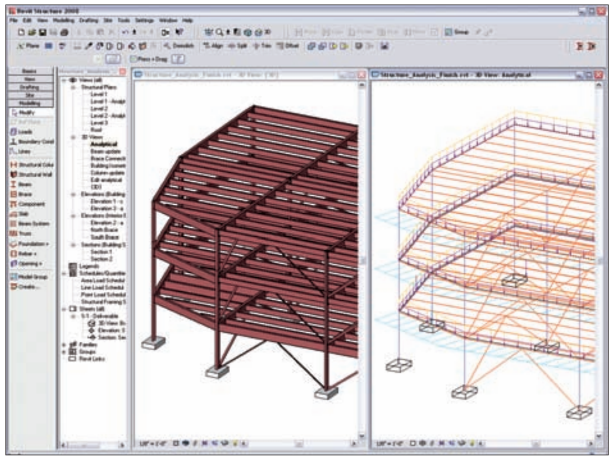
However, if an engineer considers the centre line of each wall, it can be seen that there is no continuity between the two walls. A normal approach by manual methods is to move the wall in the analysis model to ensure continuity.

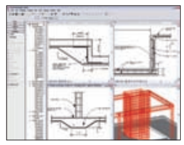
All of these challenges can be addressed using software that enables the development of both a "physical" and an "analytical" representation of the structure. The physical model is a true representation of the structure and the analytical model uses its data to create the critical information needed by the structural engineer. Crucially, both representations are fully associated, ensuring the integrity of the model both upstream and down.

Typically, engineers make assumptions in order to simplify their calculation models. These sometimes involve making the model smaller, and therefore faster to run, or making the model more suitable for the particular chosen analysis solution.

It is also common for them to use "engineering judgement" to satisfy the limitations of the analysis solution and the shortcomings of many finite element "meshers" in structural analysis solutions. For instance, they sometime ignore holes in walls and floors, simplify the shape of holes or surfaces (rectangular versus their true shape) or assume that curved walls and floors are in fact made up of many straight faces.

While the majority of these assumptions are perfectly valid when considering an analysis model in isolation, discrepancies can occur when considering the entire building information model. For example, if an engineer needs to manually change the attributes of a model just to satisfy the limitations of the analysis program, then how does that affect the update of the building information model and how is that information relayed to other members of the design team?





To prevent compromising the overall building information model, the engineer must, therefore, ensure that the chosen analysis solution is capable of directly analysing any shape of structure. Even the simplest architectural model will produce complex structural models, with features such as curved slabs or non-rectangular openings. How many architects produce buildings only with rectangular walls and no openings?

The only way that an engineer can meet these challenges is with the right software so that the generated structural analysis model accurately mirrors the "virgin" data. This is certainly true for obvious displayed information but it is also important for "non-cosmetic" data too.

We must remember that exchange of data in the BIM process rarely happens only once and that it is common to iterate between documentation and analysis models several times during the design process. In this scenario, it is important to retain data that is crucial to the analysis program, but irrelevant to drawing production.

Structural engineers can benefit greatly from BIM – as can the whole design process. However, it must be remembered that even a very basic architectural building information model can produce complex analytical solutions that the engineer must be prepared to analyse directly using their chosen analysis solution.

The best new design software enables engineers to rationalise the analytical representation before transfer to their selected analysis application – yet the selection of an analysis program that is capable of dealing in complex geometry – such as Robot Millennium from Robobat - will minimise the need to take such action.

By adopting such analysis solutions, the structural engineer can become a key part of the BIM process.

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Civil partnership

Wigan Council needed a versatile civils package to enable its engineers to work easily in 3D. The council turned to Autodesk Civil 3D.

There was a time when a designer – whether it be an architect creating a new housing estate or a civil engineer developing a new road scheme – had to have a near-complete design in their head before they committed anything to the screen. The latest software, however, is far more intuitive, enabling users to put down their concept design as it comes into their head and adjust it as the ideas flow, automatically updating all supplementary views and documentation to correspond with their revisions.

Not only does this make the design process so much smoother, but it also enables users to experiment with different versions to optimise a design within the project's parameters – for instance, to make the most of the space available.

This is certainly a feature that Chris Wilson, assistant engineer in the environmental services department at Wigan Council, is finding very useful. He has only been using AutoCAD Civil 3D for around eighteen months, but already he is enjoying the benefits. For example, it is enabling him to help the council's estates department get the best price for a brownfield site it is selling.

"This type of exercise just wouldn't have been possible using any of the other solutions the council uses. It would have taken far too long to be viable," he says.

Fast and accurate

Wigan Council uses a variety of different design software solutions – including AutoCAD, Bentley MX and Novapoint Virtual Map. However, Wilson was still on the lookout for a more versatile product that would enable him to design in 3D and would also be quick to use and to learn. His search led him to AutoCAD Civil 3D, Autodesk's AutoCAD-based design and drafting software for civil engineers.

He took to it straightaway, although he insists "I'm still relatively new to the product, but already I'm seeing the advantages of Civil 3D."

These soon became clear when Wilson began working on a project for the council's estates department. The department was selling a piece of disused council land for redevelopment. However, certain aspects of this land were causing complications and the whole project was far from straightforward.

The area was low lying and had no drainage system. As a result, only half the land could be used leaving one side free to soak away the water. The first task was to superimpose historical maps over plans to check for old abandoned mine workings – a common occurrence in the Wigan area. Wilson was then asked to design an access road for the site as it was felt that this would help the council negotiate on the price.

However, recognising that flexibility would be key to selling the land, they didn't just want one road. They wanted a complete range of scenarios – for example, different widths of carriageway, with one footpath, with two footpaths, streetlights, no streetlights and so on.

"Civil 3D was ideal for this," says Wilson. "Its dynamic model greatly reduces the time it takes to evaluate multiple ideas. You begin by quickly laying out various alignment scenarios for a proposed road. Alignments, profiles and the makeup of the corridor assemblies can then be refined until the best design proposal has been developed. With each change, all related objects and drawings update automatically."

This feature also makes the calculation of cut and fill volumes simple, fast and highly accurate. When changes are made in the design, these are updated too. So not only is it far quicker to calculate these in the first place, data can be easily provided for every design option, so adding even extra value.

Consequently, Wilson was able to provide a complete range of options and costings, helping the council to make more informed decisions about the land and making it easier to sell.

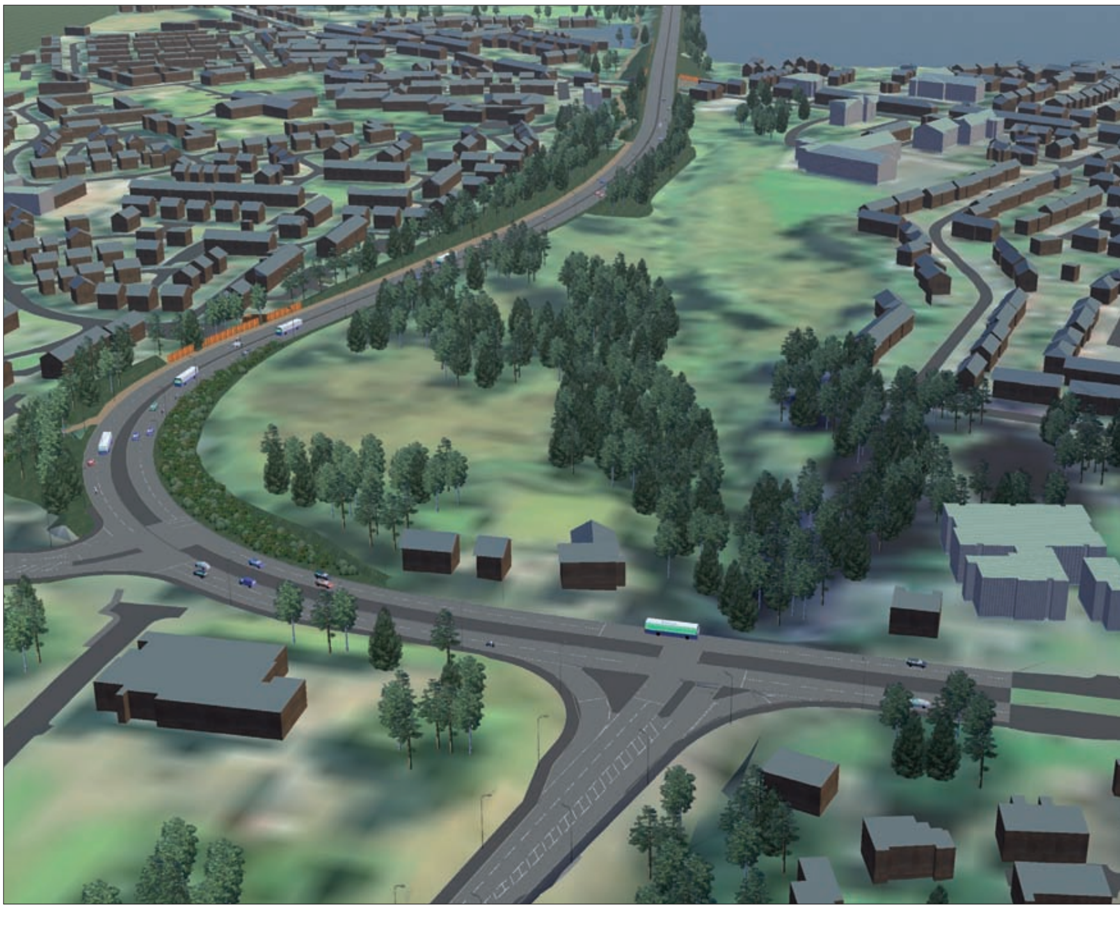
Wilson foresees Civil 3D will also help with his visualisation work. "I have been working on a 3D fly-through of a major link road which was designed in a real mix of AutoCAD, MX, and Novapoint Virtual Map with Civil 3D as a latecomer. However, I could see that it would work a lot better using Civil 3D by itself – it would have saved a great deal of time."

He has also helped the planning department in their work for a public consultation on Wigan town centre. "I have actually modelled some of the high-rise buildings on surfaces created using Civil 3D from the digital terrain model text data. This will enable the planners to give the public some idea of the dimensions of proposed buildings and how they fit their surroundings.

"I can see this will come in very useful for any new road schemes under scrutiny in the future," he says.

It is clear that Wilson thinks that he is only just scratching the surface of what Civil 3D can do for him. However, it is also apparent that the benefits are already making a difference. "I predict that Wigan Council will soon be extending its use of Civil 3D," he concludes.

www.autodesk.co.uk/civil3d



5 Churchill Place is the new headquarters building of US investment bank Bears Stearns. It was designed by HOK Architects and is currently under construction by Canary Wharf Contractors (CWC). It forms the eastern gateway to Canary Wharf and comprises four buildings. With a floor area of 28,000 m2 net, spread over 14 storeys and with a three-level basement, 5 Churchill Place is a structurally complex office tower adjacent to the global headquarters of Barclays Bank at One Churchill Place.

There were some severe constraints on the design. The site was of irregular shape and built partially over water. The structure is built over an existing 1990s car park and ramps and there were considerable problems to be faced in designing and constructing around these ramps. The building will be predominantly clad in natural stone to its principal elevations but glazed to the north. The shell and core are due to be completed in January 2009 with the fit-out due in May 2009.

Revit was used throughout the design and construction of the project and has been played an instrumental role in delivering the project on time and on budget. "Clearly, there is board level interest in delivering well coordinated projects on time, to budget," says Miles Walker, firmwide CAD Manager at architects HOK. "Our goals for Revit on this project have surpassed expectations… we will continue to work with Revit (our primary CAD software) to deliver efficient and accurate information, and to provide additional value to our clients worldwide."


Interior view of 5 Churchill place

Curves as a unified whole

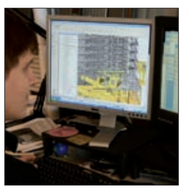
There are design precedents for 5 Churchill Place: curves as a unified whole. In 1936, Finnish architect and designer Alvar Aalto created organic glass shapes such as the Aalto Savoy vase, a shape that became a modern icon and a design influence for 5 Churchill Place. Further influences came from the work of Bridget Riley, an English painter and one of the foremost proponents of optical or op-art, art that exploits the fallibility of the human eye. Viewed from the side, the building, according to Miles Walker, is redolent of "electric stainless steel bull noses catching the sun and ambient light". Viewed from the other direction, Walker detects a "sense of vertical stone and minimal glass."

Planting the BIM seed

The cost of making design changes late on in the design and construction process is much higher than if they are made early on in the process and it is this that the buildingSMART approach concentrates on. The Industry Alliance for Interoperability defines buildingSMART as "the dynamic and seamless exchange of accurate, useful information on the built environment among all members of the building community throughout the lifecycle of a facility. HOK has, in effect, planted the BIM seed by adopting the IAI's buildingSMART with, according to Walker, "The goal to ease work processes and improve interoperability" However, it's one thing to design a building in 3D. It is another thing to base a whole project on the resultant Building Information Model. Yet that is exactly what has been achieved. Richard Bray, Building Services Coordination Manager for Canary Wharf Contractors, explains, "The whole structure has been modelled in Revit and this is the first time that CWC, our architects HOK and our structural engineers WSP Cantor Seinuk have relied on building information modelling in this way."

Very few site problems

What about the value to construction team and the services contractors? The roof of 5 Churchill Place has been particularly difficult to coordinate because of the use of the top floors as plant rooms. Here, Revit has helped clash detection with the M & E services and made such clashes easy to resolve before



construction, cutting sections almost instantaneously, and easily providing schedules. According to James Casson, WSP Cantor Seinuk, "There are over 400 construction drawings and a couple of hundred structural drawings and there have been up to ten people working on the same model at the same time. We made sure all our services contractors designed in 3D too and there have been very few problems on site given how complex a job it is."

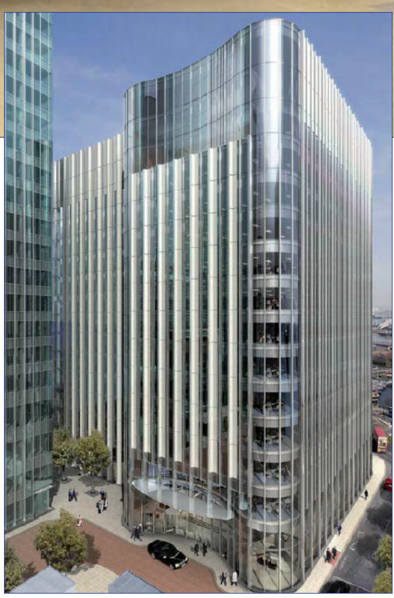
Real tangible benefits

There is a general willingness by all parties to list the benefits. For CWC, Bray comments, "Over the seven years I've been at Canary Wharf, co-ordination was always left for the contractors to do in 2D, so this is a major change. Doing it in 3D does take longer and had we had done it in 2D, the drawings would have been finished earlier. They would, however, not have

5 Churchill place

John Marchant recently visited the site of 5 Churchill place in London's Doclands to discover how Revit is being used on this latest complex office tower project from HOK architects.





The work of Finnish architect and designer Alvar Aalto, was a major design influence for the organic curved façade of 5 Churchill Place.

been correct and there would have been numerous costly and time-consuming clashes to rectify on site. Revit has therefore given us a level of security that we would not have had if we had done it in 2D with problem resolution at the design stage rather than in response to the panic calls from site."

According to James Casson, WSP Cantor Seinuk, "Using Revit Structure on this project has been positive and it has undoubtedly been a key tool to enable us in a short space of time to meet an extremely fast track construction programme."

Terry Crew, Senior CAD Technician at WSP Cantor Seinuk, "Revit does save CAD resources but it is also about better planning and organisation from the outset. A lot of the time, we used just one person to do the drawings, pulling in others as required. Had we done the project in AutoCAD, we'd have had several people on the project all the time."

Special reasons for success

Clearly, here is a practice that has made the transition to BIM and has convinced its client, consultants and contractors to do the same. HOK's Walker says, "Revit is our primary CAD system and we are using it on over 100 projects worldwide." He adds, "We've been fully committed to this for three years now. We are seeing the benefits in the speed of implementing changes and making sure the services fit when construction is under way."

There are, however, some special reasons for success. Leadership from a highly competent and persuasive firmwide CAD Manager; board level commitment to and involvement in the buildSMART process; projects with enough at stake to make the effort worthwhile and last but not least significant support from Autodesk across all fronts.

buildingSMART - www.iai-na.org/bsmart

Revit – www.autodesk.co.uk/revit

John Marchant is Consulting Editor of AEC Magazine. He also writes case studies for the skilstream partnership, where he is a senior partner.

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The BIM experience

Blair Gray, Technologist at Dyer Architects, shares his mixed experiences on the path to Building Information Modelling with Graphisoft's BIM Experience Kit.



Despite all the current talk about Building Information Modelling (BIM), there is very little information out there that enables professionals to actually see how real BIM works. Perhaps the easiest way to describe BIM is that the design is made up of parametric building elements that understand what they are and how they relate to each other. These elements collectively make up the 3D model of a building. What I wanted to know was what all this means in practice.

In discussions with CAD Managers over time, I had come across ArchiCAD as a well-established BIM software. Earlier this year, I was therefore interested to discover that Graphisoft (the author of ArchiCAD), had come out with a BIM Experience Kit on-line: an opportunity for me to try out BIM for the first time hands-on.

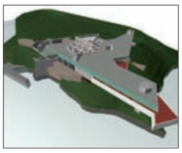
What really triggered my interest in the BIM Experience Kit was the increasing frustration of doing a lot of abortive work for contractors' preferences in the way information is set out. Just like many colleagues I've worked with, I was spending a lot of time on laborious processes: ensuring walls and doors were properly joined or up-dating changes across the board on plans, elevations and sections. I had heard that BIM made such tasks much more efficient because the models are easy to change and all documentation is fully coordinated.

Once over the initial hurdles of downloading the BIM Experience training guide and ArchiCAD 11 software in the Kit I found it very easy to use. I understand the Kit now is available as a DVD which would have saved me lots of technical issues with the download.

I particularly liked the fact the design used in the Kit is a Frank Lloyd Wright conceived building. It was satisfying to work through the BIM tutorial to be able to reproduce his design: The Massaro House in New York State. When getting to grips with new technology watching a "how-to" clip is not nearly as useful as learning by doing, but this is a lot harder to do. These run as a series of on-screen demonstration videos that are shown in a window inside ArchiCAD.

The tutorial in the Kit has 10 chapters that show how the entire Massaro House was designed "from scratch". ArchiCAD's View Map is used to guide you. By double-clicking on each View in turn, layers are turned on and off. The screen zooms to the appropriate location in the floor plan, 3D window or various other working views such as sections, elevations or details.

I liked the ArchiCAD Favourites palette which is there to simplify selecting settings for each tool. By double-clicking on a Favourite, the active tool is set for the particular type of wall, window, door, or other element type for that step. In a very painless way I could see how these tools help present the detail level of information in plan, section, elevation and 3D views and then can later be used for detail drawings.



Frank Lloyd Wright's Massaro House, on which the BIM Experience Kit is based.

A feature that I could see would be particularly helpful to me almost everyday is Virtual Trace. It is used frequently in the tutorial and it works much like trace paper enabling any view to be overlaid on top of or next to any other working view.

One of the aspects that I initially missed, but have discovered since, is the compatibility with SketchUp models. With a trial of a recently built project SketchUp model, ArchiCAD regenerated a mostly compatible model with the differences being how I built the SketchUp model to begin with.

This feature alone has great benefit simply by allowing the initial concept design to be carried through to detail design. However, I do think overall there could have been more in the Kit on how to bring in drawings and the exchange of data between different software packages. This omission is strange because Graphisoft prides itself on the unrivalled interoperability of its products.

The Kit gives you a sense of the philosophy of BIM and from this you can see the potential benefits of working this way. This plugs an important gap in the knowledge of anyone who is not too conversant with IT, and therefore finds it difficult to understand practically how things are done. The Kit is just a taster and going through it I was still left with questions about how you define detail, how a full set of documents are assembled, how 'teamwork' operates, and how the information comes out of a BIM model. At this early stage this level of detail probably does not matter because when trying to learn about BIM the main thing is to have something that will show the key points and the potential BIM has.

Having worked through the BIM Experience Kit (which took a couple of hours and gained me CPD points), now I have started trying out ArchiCAD 11, as the Kit includes a free 30 day license. My first impression is that some of the myths about how complicated it can be to work in 3D are not so true. For instance it is easy to believe that lots of detail has to be modelled initially whereas it is possible to start with a simple "concept" model and gradually incorporate more and more detail as you progress with the design. It is a lot less hassle to change and up-date as you design and not have to accurately consider the interfaces of detail early on. As a technologist using BIM, I will certainly be able to foresee problems better before heading on site. Getting diagrams from the model and turning diagrammatic drawings into worked up presentation images appears to be a relatively seamless procedure.

At my practice we're aware that the move to embracing what BIM can do for architects is by and large a very gradual one. If a practice wants to implement BIM I think this will be a good thing for them as long as they realise this is something that needs to be supported from the top. The investment in training teams and setting up new processes across the practice is a big challenge and beyond the scope of what any introductory Kit could ever achieve.

I am part of a team at Dyer making this shift happen and am encouraged by the support we get to research what IT means for best practice. The next step is to get the right pilot project for BIM so we can really assess the potential for ourselves. I am sure a large number of practices are finding that they need to review these IT issues in this very way. I dare say those who go for it in the near future will have a significant head-start in responding to client needs, especially on large-scale projects.

To request a BIM Experience Kit DVD click on ***http://info.graphisoft.co.uk/bim***

Blair Gray is a Technologist at Dyer. The practice has over 500 staff with offices in Dublin, Madrid, Moscow, and Paris.

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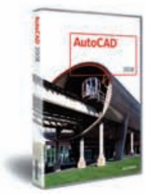
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Lenovo workstations

This month Lenovo unveiled its first ThinkStation line of workstations. The company partnered with long term customer, the AT&T Williams Formula One team, for the launch event. **John Marchant** reports.

On November 6, 2007, Lenovo launched their new ThinkStation line of workstation PCs in conjunction with the AT&T Williams Formula One team at the RBS Williams F1 Conference Centre. This is the first time in ten years that a major PC vendor has entered a market that the likes of Dell, HP and Sun have largely had to themselves. Although the workstation market is small compared with the laptop and business desktop market, growth in Europe is around 10% pa compared with 6% or so for servers. Lenovo is setting its sights on winning a substantial share of the sector and is already collaborating with 26 leading independent software vendors to certify seamless hardware and software interaction. Alex Burns, chief operating officer, Williams F1 is already impressed, "The new workstations will help change the way our engineers work with faster interaction and design simulation and we are evaluating them for integration into our operations."

Latest Intel technology

Targeted at professionals in the computer-aided design/engineering, digital content creation, oil and gas exploration and electronic design automation segments, the Lenovo ThinkStation S10 and D10 workstations are built on the very latest technology, the first Intel processors based on 45 nanometer technology, nearly doubling the density of transistors on the chips compared with previous Intel processors. The dual processor ThinkStation D10 workstations use the fastest Quad Core Intel Xeon processor 5400 series, while the single processor ThinkStation S10 workstations use the latest Intel Core 2 processors including the Intel Core 2 Extreme processor QX9650. The new workstations can take two of the latest high-end GPUs from Nvidia and come equipped with dual Gigabit Ethernet and multiple slots, bays and USB ports.

Lenovo has designed the workstations to comply with the Environmental Protection Agency's Energy Star 4.0 requirements for energy usage with 80% efficient power supplies. Additionally, they contain more than 50% recycled plastics content.

The workstations also incorporate a removable top handle for moving the workstation as well as a side cover latch for easy access to the system. The workstations are claimed to have the same acoustic noise levels as the standard Lenovo desktop PC. The workstations also come equipped with a range of ThinkVantage technologies including Rescue and Recovery, Client Security System and Image Ultra



Builder and Lenovo will offer a variety of storage, graphics adapters, memory and rail kits for the workstations.

ThinkStation workstations should be available starting in January through Lenovo business partners and www.lenovo.com. Pricing for the ThinkStation S10 workstation will start at around £600 and the ThinkStation D10 workstation will start at around £900.

Williams F1 and Lenovo

For those of you who have been on a desert island for the last 29 years, AT&T Williams is one of the world's leading Formula One teams, with 16 FIA Formula One World Championship titles and 113 Grand Prix victories to its credit. Williams F1 is based at a 40 hectare technology campus in the heart of the UK's motorsport valley in rural Oxfordshire. Williams F1, which was formed in 1978 and is privately owned by Sir Frank Williams and his long-term business partner, Patrick Head, designs, manufactures and races Formula One cars and employs some 520 people, 80 percent of whom are involved in design, manufacturing and race operations. Also, for those who don't know already, Lenovo, formed by Lenovo Group's acquisition of the former IBM Personal Computing Division, develops, manufactures and markets technology products and services worldwide with major research centers in Yamato, Japan; Beijing, Shanghai and Shenzhen, China; and Raleigh, North Carolina.

Brand awareness and technology partnership

At the beginning of the 2007 race season, Lenovo announced its support as an Official Partner of AT&T Williams. F1 is a computing-intensive endeavour and is highly dependent on information technology, with the team using Lenovo PC technology in every facet of its business. The company uses around 400 Lenovo PCs - approximately 130 notebook PCs and 270 desktop PCs. Although Lenovo's sponsorship of the team is about brand awareness, it is also about sending the Lenovo message directly to its customers. Williams, though sees it as more of a technology partnership, with workstation technology regarded by both Lenovo and Williams as similar to Formula One in the way it pushes the boundaries of technology with an eventual trickle-down into general use.

Looking for improvement

According to Chris Taylor, IT Manager at Williams F1, "In Formula One, the car changes completely every year. In fact, we design some components specifically for use for only one race at one circuit and workstation performance can be a limiting factor for us when we are redesigning parts to such tight deadlines. When we moved to dual core workstations, we got a real improvement in productivity, allowing us to run certain CAD and CAE applications at the same time, really compressing our design times. We are looking to the new ThinkStations to provide a further significant improvement."

Supercomputing power for aerodynamic simulation

Lenovo and Williams have also been working together on the development of a supercomputer to run CFD simulations of airflow around a virtual model of a three-dimensional racing car to help predict how changes in component shape and placement will affect drag and downforce, with resulting impacts on speed and handling. "Aerodynamics plays a critical role in determining how competitive we are for each of the race circuits we visit," according to Alex Burns. The team uses the supercomputer to examine numerous aerodynamic variables, such as surface geometry, wheel turbulence and track surface. With a peak performance of eight teraflops, the supercomputer, based on a cluster of 166 Lenovo R520 SuperServers, is four times more powerful than the team's previous solution. This enables the team to run aerodynamic simulations approximately 75 percent faster than before.

www.lenovo.com





Value and service?

In the first of his two articles this month, **Rob Jamieson** takes a closer look at the balance between value and service in the CAD software industry.

I've recently been re-awakened by an old hobby of mine which has meant that I've been spending a lot of time on eBay looking for parts. What has surprised me is that people pay more than the price for new products but only if they are well known brands. You could put this down to a bidding frenzy but I think that it is because people recognise the value of premium brands and the services that these brands offer. The same applies to the CAD industry.

Today there are so many ways to buy products, CAD software included. CAD software consists of mainly IP (Intellectual Property) and has few physical components so it can be purchased in different ways. There are hot debates around which are the best ways to sell software. Some software can be purchased online, as there are no physical objects to distribute, and support can be given online by a forum. The opposite approach is to purchase it from a local dealer who will supply, support and install the software for you.

From the manufacturer's perspective the first approach is the cheaper way to distribute the product but then they don't have their local resellers evangelising about how good their stuff is. These resellers also offer local support and feedback to the creators. I once had an American software developer in the CAD industry tell me that, in Europe, the metric engineering default unit was the cm and it messed his plans up when I informed him it was mm. However, this demonstrates at a basic level that local feedback is important.

One of the most important things about having a local point of contact from which to purchase, and therefore ensure infrastructure support, is that generally they are awake at the same time that you are. This means you can ring them up and talk to them! In most design departments there are peaks in business demand and I've been involved where the reseller has either provided manpower or created standard parts or layouts quickly so that deadlines can be met. As the reseller is relatively local they should understand your business.

Inside job

If your company has its own "inside expert" some of this work can be done by them. One of the biggest problems for a company is keeping these experts within the company, as multi-discipline staff are always in demand. People that understand what your company makes, and have experience in CAD administration as well, have transferable skills that many other companies want.



The other side of all this is where manufacturers keep all of the standards to themselves so that people have to buy their next product. The hardware industry is littered with such examples. However, I have my own to draw on.

DIY expert

When I was an IT manager in a group of companies, the corporate policy was to have a mini computer system based on a flavour of Unix. It was a good implementation for the time, not least because it stored all the accounts and resource planning on it, and so was crucial to the company. After three years (in the good old days hardware signoff was five years at least) I began getting some reports of drive errors from the monitoring software. There had been a management buy out so I had no help from the guys who forced me down this route. We were well backed up but I needed it working so it didn't affect production but the support company said that as the drives were now obsolete (320MB 5.25 inch drive) that we would need to buy a new mini computer. This was £30,000 at least just for the hardware.



> **"If software companies continue to try and keep their software in some way proprietary with file formats etc, a cheaper and easier solution might come along and change the game."**

The other option was a reconditioned drive, i.e. a used one which was £1,000+ and bound to be just as old as the ones I had plus they only came with a three month warranty! I had no real choice but to buy from them; something that just wouldn't happen today since standardisation with PC components and systems has allowed choice and value. In fact, to keep to my budget I found in a magazine (the Internet was still young for this) a 'just launched' three inch OEM 1GB drive for a PC system from the same manufacturer. The problem was that it wouldn't fit the cage in the system (this was deliberate I think by the manufacturer). So off I went to the shop floor and drilled some holes into some mild steel and made it fit. The production director was a little surprised that I could do this, but £300 is a lot better than £30,000!

A bit of driver trickery and a big lunch for the support company's sales manager to say they would support it and it was still working fine two years later when I left the company. I had people waiting around to enter purchase orders so I had to act fast and the fact hardware support didn't cover this was bad but, because I had enough knowledge to fix it, I had become an inside expert.

Protecting investments

Companies are constantly tinkering with different ways to market products – certain products needing certain routes - until the captive audience model, as cited in the example above, becomes impossible to retain. This tends to apply to software more than hardware as it costs less to ship and can therefore become a commodity for which people then expect to pay less. The development costs are still there but if software companies continue to try and keep their software in some way proprietary with file formats etc, a cheaper and easier solution might come along and change the game. I'm all for protecting intellectual property but this should always be balanced with increasing the feature count and furthering the course of technology in the knowledge that everything becomes mainstream in one way or another. Remember car phones? Now five year old children have their own phones, look how many garden design programs (CAD) there are available today?

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Life in Tokyo

In the second of his two articles this month, **Rob Jamieson** takes a break from his usual stomping ground of technology and shares his experiences of culture and business in Japan.



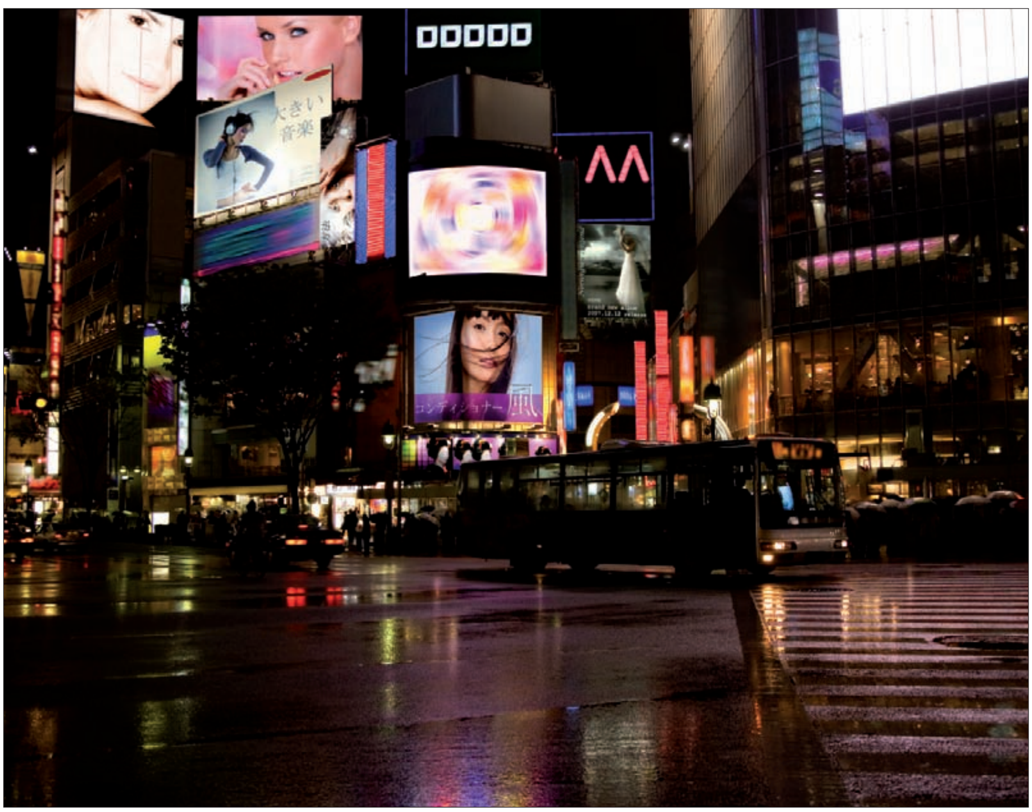
This month I thought I'd take a look at industry from a different perspective – from that of the Japanese. "Why?" you may ask. Well I was recently lucky enough to do some work in Tokyo and the city just fascinates me – both on a cultural level and for its technology. I spent some time with a number of software companies and end users and their views on technology are closer to the UK's mentality than I thought.

Originally there were a lot of home grown 2D CAD solutions in Japan but with the prohibitive costs to develop 3D tools there is now a lot more adoption of global CAD solutions. Anybody who has visited Tokyo will know that there is a massive density of people in a small area. This means that the design of structures and objects needs 3D to be able to compress as much as possible into a small area. For example, when visiting one software launch event I arrived in the subway which had four levels of shops and businesses before I even got to ground level. At ground level there was a large shopping arcade with eight floors with a 35 storey tower block on top of that. Of course all of this has to be earthquake resistant as well.

Design and new technology is very important to the Japanese - they like to buy new and not second hand. Second hand goods fetch a lot less money than new products. Ebay is not so popular in Japan and Yahoo auctions are full of second hand goods we would think very cheap in the UK. This constant desire for new products means design is an important tool to create new products in a very short space of time for the domestic market.

In general, the Japanese expect all goods to be of high quality. The high-end CAD software tends to be more popular, which fits with their perception of high quality. With a fair amount of high-end CAD software in use there is a strong market for skilled designers. A lot of Japanese still have the 'job for life' view so they prefer to stay with the companies they started with. However, as learning Japanese is difficult I don't expect a sudden inrush of western designers.

We often have the perception that the Japanese copy our ideas. I think it's more to do with the insular nature of Japan itself. With the language and the traditions of life and business I feel that they don't understand the Western ideals and therefore emulate what they don't understand the best way they can. The West has had many influences over Japan and even with the occupation of the US forces after the Second World War, they have retained their traditional values and are still very trusting. A typical example is that we, in the West, like to know the price of a product or service before we purchase but the Japanese will often ask for an install of software and a system setup without having agreed the price before hand. They expect the supplier to be honest.



Shibuya station, Tokyo.

Hierarchy and status are very important to the Japanese. Decisions are often deferred to a higher power and because of this it can be very hard to get a quick answer, and rather than say no they will keep delaying. Having talked to a number of design engineers I found the lead designer takes all the decisions, rather than a group decision. This seems to lead to sometimes single minded designs - either very good or very bad.

Actually conducting a meeting in Japan is ritualised and is started by an exchange of business cards and then the seating positions in the room are based on hierarchy. If you take into consideration business lunches as well, if the middle of the seating arrangement, with your back against the wall, furthest away from the door is your position you are doing well. If you are on the edge, you are lower in the pecking order. As a Westerner I could of course take a few liberties but the local guys hosting me always pointed me to sit in the correct place.

The Japanese honour their source of supply as it's a relationship based on trust and this is a core ingredient for their success. When Japan implemented the American organisation regime that became JIT (Just in Time) with the Kanban stock system it took the manufacturing world by storm. They then followed with Kaizen, constant improvement methodology, I could understand that the natural tendency of hierarchy and order of the Japanese would help this work. By the time the West tried to implement these methodologies it was too late to compete. Now we all face competition from a cheaper country China which has taken methodologies and applied it to its cheap labour force. Just like the UK a lot of products in Japan are manufactured in China - it is seen as a necessary evil to remain competitive, for them and for us.

Japan is full of contrasts - in Tokyo only major roads are marked on the map and to find any secondary location you need an individual map with local landmarks as roads don't have names and there is no numbering system for each office block. It's extremely hard to find any location even for the Japanese and in such a densely populated city it's really surprising that a better system has not been implemented. Japan is fighting against its own history to modernise and to lose its insular nature, but I think it's a major force never to be underestimated.

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